

REMARKS

I. Drawings

The Office Action objects to the drawing because it was incorrectly numbered and abbreviated as "Fig 1." Accordingly, Applicants have submitted a corrected Figure and deleted reference to Figure 1 in the specification. Therefore, Applicants respectfully request withdrawal of this ground of rejection.

II. Claim Objections

The Office Action rejects Claims 4-9 under 37 C.F.R. § 1.75(c), as being in improper form because a multiple dependent claim cannot depend from a multiple dependent claim. Accordingly, Applicants have amended Claims 4-7 and 9 to be dependent upon independent Claim 1, and Claim 8 has been amended to being dependent upon Claim 7. Therefore, Applicants respectfully request withdrawal of this ground of objection.

III. Claim Rejections - 35 U.S.C. § 112.

The Office Action rejects Claims 1-3 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Office Action states that Claims 1-3 recite "characterized in that," which is improper and unclear claim language. Accordingly, Applicants have deleted the phrase "characterized in that" and replaced it with "wherein." Therefore, Applicants respectfully request withdrawal of this ground of rejection.

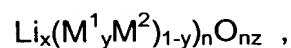
IV. Rejection under 35 U.S.C. §103(a).

Claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Riley (United States Patent No. 4,567,031) in view of Lecerf, et al. (United States Patent No. 4,980,080) and Von Sacken (United States Patent No. 5,180,574). Specifically, the Office Action states that Riley discloses a process for preparing a mixed metal oxide having the formula $Li(Co_{0.5}Ni_{0.5})O_2$ by preparing a mixture of a soluble oxygen-containing salt of lithium and a soluble oxygen-containing salt of at least one metal, and calcining the mixture to form the mixed metal oxide. The Office Action further states that Riley does not disclose Applicant's claimed lithium

compound or performing calcinations in a moving bed. Additionally, the Office Action states that Lecerf, et al. teaches a metallate having the formula $\text{Li}_{0.9}\text{Ni}_{0.91}\text{Co}_{0.09}\text{O}_2$ and that Von Sacken teaches producing lithium mixed metal oxides using rotary calciners and fluid beds, which are moving beds.

According to the Office Action, it would have been obvious to one of ordinary skill in the art to modify the teachings of Riley by producing the instantly claimed lithium mixed metal oxide as disclosed by Lecerf, et al. and performing calcinations in a moving bed for the production of lithium mixed oxides as taught by Von Sacken, because the composition as claimed by Lecerf, et al. may be prepared by the process of Riley, which discloses a process for the preparation of lithium metal oxides. Furthermore, according to the Office Action, it would have been obvious to one of ordinary skill in the art to perform calcining of lithium mixed metals in moving beds because Von Sacken teaches producing lithium mixed metal oxide wherein calcining is performed in moving beds. According to the Office Action, such modification would have been obvious to one of ordinary skill in the art, because one would expect a process for calcining lithium mixed metal oxides as taught by Von Sacken and a lithium metallate having the formula taught by Lecerf, et al. to be similarly useful and applicable to a process for preparing metallates, which include a step of calcining the lithium, transition metal precursor as taught by Riley.

Applicants respectfully traverse this ground of rejection. Amended Claim 1 of the present invention is directed to a process for preparing lithium transition metallates of the general formula



wherein

- M^1 represents nickel, cobalt or manganese,
- M^2 represents chromium, cobalt, iron, manganese, molybdenum or aluminium and is not identical to M^1 ,
- n is 2 if M^1 is manganese, otherwise 1,
- x is a number between 0.9 and 1.2,
- y is a number between 0.5 and 1.0 and

z is a number between 1.9 and 2.1, by calcining an intimate mixture of oxygen-containing transition metal compounds and an oxygen-containing lithium compound, which has been obtained by treating a solid powdered transition metal compound with a solution of the lithium compound and drying, wherein at least the M¹ compound is used in the form of a powder with a specific surface area of at least 10 m²/g (BET) and calcination is performed in a moving bed.

Applicants respectfully submit that the fact that references can be combined or modified to arrive at the instant invention is not sufficient to establish prima facie obviousness, similarly the fact that the claimed invention is within the capabilities of one of ordinary skill in the art is not sufficient by itself to establish prima facie obviousness. "There are three possible sources for a motivation to combine references: the nature of the problem being solved, the teachings of the prior art, and the knowledge of person of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teachings, suggestions, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See MPEP 2143.01. The ***teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art***, not in applicant's disclosure. See MPEP 2143, citing In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added).

Applicants respectfully submit that there is no motivation to combine the teachings of Riley, in view of Lecerf, et al. and Von Sacken to arrive at the instant invention. As previously stated in the Office Action, Riley does not teach or suggest Applicants' claimed lithium compounds or a process for preparing the compounds by performing calcination in a moving bed. Applicants submit that there is no motivation to combine the teachings of Lecerf, et al. and Von Sacken to supplement the deficiencies of Riley.

According to the Office Action, Lecerf, et al. teaches a metallate which is encompassed by the claimed invention and that one skilled in the art would have found it obvious to produce the metallate disclosed by Lecerf, et al. by the process taught by Riley. However, Applicants submit that there is no motivation in Lecerf, et al. to prepare metallate compounds according to the process disclosed by Riley. In the alternative, Lecerf, et al. teaches preparing metallate compounds by preparing a powdered mixture of lithium, nickel and cobalt in the material, of lithium hydroxide and either nickel oxide or a mixture of nickel or cobalt oxide and heating the mixture in air at a temperature in the range of from 600°C to 800°C. Further, Lecerf, et al. discloses a process for preparing metallate compounds which are "simplified when compared to methods described in the prior art." See column 1, lines 33-36. Therefore, Applicants submit that there is no motivation to produce the metallate disclosed in Lecerf, et al. by the process disclosed in Riley.

Also, according to the Office Action, Von Sacken teaches producing lithium mixed metal oxides using rotary calciners and fluid beds, which are moving beds. Von Sacken discloses a process for forming a hydride of lithiated nickel dioxide having a formula $\text{Li}_{x-z}\text{H}_z\text{Ni}_{2-x-y}\text{M}_y\text{O}_2$. Applicants respectfully submit that there is no motivation in Von Sacken to produce the lithium compounds of the present invention and as previously argued, Lecerf, et al. provides no motivation to produce the presently claimed metallate compounds using the process disclosed by Riley in conjunction with Von Sacken. For at least these reasons, Applicants respectfully submit that the claimed invention would not have been obvious in view of Riley, in view of Lecerf, et al. and Von Sacken.

V. Rejection under 35 U.S.C. §103(a).

Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Riley (United States Patent No. 4,567,031) in view of Lecerf, et al. (United States Patent No. 4,980,080) and Von Sacken (United States Patent No. 5,180,574) as applied to Claim 1 above, and further in view of Mao (United States Patent No. 5,728,367). The Office Action stated that Mao teaches a method for preparing lithiated transition metal oxides and wherein the materials after heating are subjected to a grinding process in a conventional mill. Also, the Office Action states

that Mao continues to teach that after the milling process that the lithium transition metal oxide by products may be re-used and reprocessed. According to the Office Action, it would have been obvious to one of ordinary skill in the art to modify the teachings of Riley, Lecerf, et al. and Von Sacken by milling the transition metallate after calcining and recycling the milled transition metallate back to the reaction bed, because Mao teaches after calcining a lithium transition metal oxide, the lithium transition metal oxide is milled and recycled back to the reactor. Such modification, according to the Office Action, would have been obvious to one of ordinary skill in the art, because one would expect a process for fabrication lithium transition metal oxides as taught by Mao to be similarly useful and applicable to a process for producing lithium transition metal oxides as taught by Riley, Lecerf, et al. and Von Sacken.

Applicants, respectfully traverse this ground of rejection. Amended Claim 2 of the present invention is directed to a process according to Claim 1, wherein the transition metallate is milled and sieved after calcination and the finer fraction from sieving is recycled to the moving bed.

Applicants' previous arguments with regard to Riley, Lecerf, et al. and Von Sacken are incorporated herein. Further, Applicants submit that there is no motivation to combine the teachings of Mao with the aforementioned references. Mao teaches a method for preparing a lithiated transition metal oxide, in which after mixing the precursor materials and heating the materials twice, the materials are cooled and subjected to a grinding or milling process. Thereafter, the materials are heated again, or alternatives introduced into an oven. Additionally Mao teaches steps for **reprocessing** the by-products into new starting or precursor materials. Mao teaches treating NO_x gas, which is a by-product of the process, to form nitric acid and then reacting the nitric acid with lithium hydroxide to form lithium nitrate, which is a starting material.

Mao provides no motivation to gently mill the powdered lithium transition metallate emerging from the moving bed as claimed in the present invention, nor does Mao provide any motivation to either **recycle the milled metallate** to the moving bed or mix the milled metallate together with the solution of oxygen

containing lithium compounds. Further, there is no motivation in Mao to combine its teachings with the teachings of Riley, Lecerf, et al. and Von Sacken. For at least these reasons, Applicants respectfully submit that the claimed invention would not have been obvious in view of Riley, in view of Lecerf, et al. and Von Sacken and Mao.

VI. Rejection under 35 U.S.C. §103(a).

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Riley (United States Patent No. 4,567,031) in view of Lecerf, et al. (United States Patent No. 4,980,080) and Von Sacken (United States Patent No. 5,180,574) as applied to Claim 1 above, and further in view of Yazami, et al. (WO 94/25398). Specifically, the Office Action states that Yazami, et al. teaches a method for the preparation of lithium and transition metal mixed oxides having the formula $\text{Li}_{ny}(\text{M}_1 \cdot x\text{M}'_x)_n\text{O}_{nz}$ in which n is 1 or 2, and M and M' are the same or different. According to the Office Action, it would have been obvious to one of ordinary skill in the art to modify the teachings of Riley, Lecerf, et al. and Von Sacken by having a mixed transition metal compound wherein the transition metal compound M_1 and M_2 contain the same compounds, because Yazami, et al. teaches a method for producing lithium transition metal oxides, wherein the transition metals are the same or different.

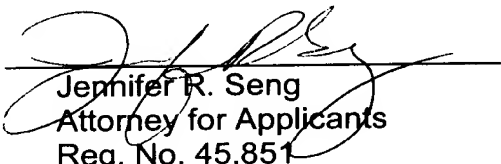
Applicants respectfully traverse this ground of rejection. Amended Claim 3 is directed to a process according to Claim 1 wherein a mixed transition metal compound which contains at least some of the M^2 compound is used in a solution of the lithium compound for impregnating the M^1 compound

Applicants' previous arguments with regard to Riley, Lecerf, et al. and Von Sacken are incorporated herein. Applicants further submit that Yazami, et al. provides no motivation for at least some of the M_2 transition metal compound to be used as a solution constituent in the solution of the lithium compound for impregnating the M_1 transition metal compound. In the alternative, Yazami, et al. only teaches a compounds wherein two metal oxides are present, which can be the same or different. Yazami, et al., in combination with Riley, Lecerf, et al. and Von Sacken provides no motivation to utilize chromium, cobalt, iron, manganese,

molybdenum or aluminum as a solution constituent in the solution of the lithium compound for impregnating nickel, cobalt or magnesium. For at least these reasons, Applicants respectfully submit that the claimed invention would not have been obvious in view of Riley, in view of Lecerf, et al. and Von Sacken and Yazami, et al.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

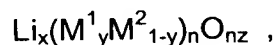
IN THE SPECIFICATION:

Please delete the paragraph beginning on page 7, line 17 and ending on page 7, line 31 and replace with the following:

[Fig. 1] The Figure is a schematic diagram of a preferred embodiment of the present invention of producing lithium nickelate. The pre-mix production unit A consists of a stirred container, in which a 40% strength aqueous lithium nitrate solution is initially placed, into which is stirred the powdered β -nickel hydroxide with an average particle size of 10 μm and a specific surface area of $65\text{m}^2/\text{g}$. The slurry obtained is dried by spray drying and introduced into rotary kiln B as granules with an average particle diameter of about 100 μm . The contents of the kiln are held at sinter temperature under an inert gas for preferably 1 to 3 hours. Then (with batch operation), the argon atmosphere can be replaced by an atmosphere containing 20 to 50% oxygen. Then the rotary kiln is cooled and the lithium nickelate obtained is milled in a fluidised bed counterstream mill C to a particle diameter of less than 40 μm and the fine fraction with particle sizes of less than 3 μm are separated by air classification or in a cyclone and collected for recycling to kiln B. The NO_x -containing kiln atmosphere is scrubbed with aqueous lithium hydroxide solution in scrubber D and the lithium nitrate obtained is recovered for the production of another premix.

IN THE CLAIMS:

1. (Amended) A process for preparing lithium transition metallates of the general formula



wherein

- M^1 represents nickel, cobalt or manganese,
 M^2 represents chromium, cobalt, iron, manganese, molybdenum or aluminium and is not identical to M^1 ,
 n is 2 if M^1 is manganese, otherwise 1,
 x is a number between 0.9 and 1.2,

y is a number between 0.5 and 1.0 and

z is a number between 1.9 and 2.1,

by calcining an intimate mixture of oxygen-containing transition metal compounds and an oxygen-containing lithium compound, which has been obtained by treating a solid powdered transition metal compound with a solution of the lithium compound and drying, [characterised in that] wherein at least the M^1 compound is used in the form of a powder with a specific surface area of at least 10 [20] m^2/g (BET) and calcination is performed in a moving bed.

2. (Amended) A process according to Claim 1, [characterised in that] wherein the transition metallate is milled and sieved after calcination and the finer fraction from sieving is recycled to the moving bed.
3. (Amended) A process according to Claim 1 [or 2, characterised in that] wherein a mixed transition metal compound which contains at least some of the M^2 compound is used [as the] in a solution of the lithium compound for impregnating the M^1 compound.
4. (Amended) A process according to [one of Claims] Claim 1 [to 3, characterised in that] wherein the solution of lithium compound contains at least some of the M^2 compound.
5. (Amended) A process according to [one of Claims] Claim 1 [to 4, characterised in that] wherein calcination is performed in a rotary kiln, in a fluidised bed or in a fall-shaft reactor (downer).
6. (Amended) A process according to [one of Claims] Claim 1 [to 5, characterised in that] wherein following calcination, milling is performed and, after milling, further calcination is performed in an oxygen-containing atmosphere.

7. (Amended) A process according to [one of Claims] Claim 1 [to 6, characterised in that] wherein LiNO_3 is used as the lithium compound and $\text{Ni}(\text{OH})_2$ is used as the M^1 transition metal compound.
8. (Amended) A process according to Claim 7, [characterised in that the] wherein NO_2 released during calcination is recovered as nitric acid and is reacted with LiOH to give LiNO_3 which is used as the lithium compound.
9. (Amended) A process according to [one of Claims] Claim 1 [to 8, characterised in that] wherein the transition metal compound treated with the solution of a lithium compound is dried by spray drying or mixer granulation.